

Remarks

The preceding amendments and following remarks are submitted in response to the Official Action of the Examiner mailed October 4, 2000. Claims 1-43 remain pending. Reconsideration, examination and allowance of all claims are respectfully requested.

On page 2 of the Office Action, the Examiner states that the title is not descriptive. The Examiner suggests that the title be changed to --LED with reflector and UV Bragg Mirror--. After carefully reviewing the present specification and claims, Applicants respectfully disagree with the Examiner's suggested title. Applicants would like to point out that many of the claims do not recite a UV Bragg Mirror. For example, claim 1 recites a reflector, which in some embodiments is a metal layer, not a UV Bragg Mirror. In another example, claim 23 does not recite a reflector at all.

The original title of "Efficient Solid-State Light Emitting Device with Excited Phosphors For Producing a Visible Light Output" seems to be highly descriptive. Claim 1, for example, recites a radiation source positioned adjacent a phosphor layer for providing a radiation to excite a light emission from the phosphor layer. Independent claims 4, 21, 23 and 40 include similar limitations. Thus, the present claims are directed at an efficient solid-state light emitting device with excited phosphors for producing a light output. In view of the foregoing, Applicants traverse the Examiner's objection to the title of the invention, and respectfully request reconsideration by the Examiner.

Also on page 2 of the Office Action, the Examiner rejected claim 11 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claims the subject matter of the invention. The Examiner states that the phrase "corresponds" found on page 15, line 2 of claim 11 is considered vague and indefinite. In response, Applicants have amended

claim 11 to remove the phrase "corresponds to", and now believe that claim 11 and dependent claims 12-16 fully comply with 35 U.S.C. §112, second paragraph.

On page 3 of the Office Action, the Examiner rejected claims 1-5, 7, 18-20, & 23-28 under 35 U.S.C. §102(b) as being anticipated by Shakuda (U.S. Patent No. 5,557,115). The Examiner states that Shakuda discloses: a light emitting device (chip, figure 8) comprising a phosphor layer (light emitting layer 5) having two opposing sides including one or more excitable light emitting phosphors (InGaN emitting layer, #5, column 4, lines 25-32); and a radiation source (laminate 7) positioned adjacent a first one or the two opposing sides of the phosphor layer for providing radiation to excite a light emission from the phosphor layer. The Examiner states that the radiation source has a first contact region (electrode 10) and a second contact region (electrode 9) and reflector means (Au-Sn electrode 10) provided adjacent a second one of the two opposing sides of the phosphor layer for reflecting at least some of the radiation and light emission that exits from the phosphor layer back into the phosphor layer as specifically recited in claim 1.

After careful review, Applicants must respectfully disagree with the Examiner that Shakuda suggests using a phosphor in conjunction with a radiation source. Shakuda merely shows a double heterostructure blue LED. The Examiner states that the light emitting layer 5 of Shakuda corresponds to the phosphor layer of the present invention. The light emitting layer 5 of Shakuda is an InGaN layer, which is a quantum well layer that emits light when excited by injected current, as is well known in the art. The light emitting layer 5 of Shakuda is interposed between the upper P-type AlGaN cladding layer 61 and the lower N-type AlGaN cladding layer 42. The light emitting layer 5 and upper 61 and lower 42 cladding layers collectively form a double heterostructure LED.

It may be instructive to compare the LED structure of Shakuda to the LED shown in Figure 4 of the present specification. Figure 4 of the present specification is a schematic diagram showing an illustrative UV LED device that has a single quantum well. As noted in the present specification, the UV LED device of Figure 4 can be used as a radiation source to excite a phosphor layer or coating, and shown in Figures 1-3 of the present specification.

The UV LED device of Figure 4 includes: a lower N-AlGaN layer 110, which corresponds to the N-AlGaN layer 42 of Figure 1 of Shakuda; an upper P-AlGaN layer 112, which corresponds to the P-AlGaN layer 61 of Figure 1 of Shakuda; and a single GaN quantum well layer 114 therebetween, which corresponds to the InGaN layer 5 of Figure 1 of Shakuda. Note that the present specification states that “[d]epending on the desired wavelength, it may be beneficial to replace the GaN quantum well material with InGaN (specification, page 11, lines 15-16), which is the same material used in the InGaN light emitting layer 5 of Shakuda. As can readily be seen, the light emitting layer 5 of Shakuda is merely a quantum well layer, and not a phosphor as recited in the present claims.

In addition to the foregoing, the Examiner states that the laminate 7 of Shakuda corresponds to the radiation source of the present invention. However, and referring to column 4, lines 10-15 of Shakuda, laminate 7 includes the N-type GaN layer 41, the N-type AlGaN layer 42, the InGaN layer (which is the light emitting layer 5 discussed above), the P-type AlGaN layer 61, and the P-type GaN layer 62. Thus, according to the Examiner’s interpretation of Shakuda, the InGaN light emitting layer 5 functions both as the radiation source and as the phosphor. Applicant respectfully submit that this cannot be a proper reading of Shakuda.

Claim 1 of the present invention recites:

1. A light emitting device comprising:

a phosphor layer having two opposing sides including one or more excitable, light-emitting phosphors;

a radiation source positioned adjacent a first one of the two opposing sides of the phosphor layer for providing a radiation to excite a light emission from the phosphor layer, the radiation source having a first contact region and a second contact region; and

reflector means provided adjacent a second one of the two opposing sides of the phosphor layer for reflecting at least some of the radiation and light emission that exits from the phosphor layer back into the phosphor layer.

Thus, claim 1 recites a light emitting device that includes both a phosphor layer and a radiation source. Since Shakuda fails to suggest a phosphor layer or coating, and more specifically, a phosphor layer or coating that is excited by a radiation source, Shakuda cannot render claim 1 unpatentable. The remaining independent claims, namely claims 4, 21, 23 and 40 also recite a phosphor and a radiation source. Therefore, all pending claims 1-43 are believed to be clearly patentable over Shakuda.

On page 6 of the Office Action, the Examiner rejected claims 6, 8-17, 21, 22, 29-39 and 40-43 under 35 U.S.C. §103(a) as being unpatentable over Shakuda as applied to claim 4 and 5 above in view of common knowledge in the art. For the same reasons discussed above, Applicants believe that claims 6, 8-17, 21, 22, 29-39 and 40-43 are clearly patentable over Shakuda.

Having thus addressed each objection and ground of rejection of the Examiner, all pending claims are now believed to be in condition for allowance. Entry of the present amendment and reconsideration to that end is respectfully requested. If the Examiner would like to discuss the application or its examination in any way, please call the undersigned attorney at (612) 677-9050.

Respectfully submitted,

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By their attorney,

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